CLAIMS:

1. A method of processing seismic data representing a physical system, the method comprising:

forming a difference between first and second seismic data representing the system in first and second states, respectively; and

inverting the difference in accordance with a parameterised model of the physical system to obtain changes in the parameters of the model.

2. A method as claimed in claim 1, wherein the first and second states represent the physical system at different times.

3. A method as claimed in any preceding claim, wherein the inversion is performed in a statistical environment.

4. A method as claimed in claim 3, wherein the inversion is a least squares inversion.

5. A method as claimed in claim 3, wherein the inversion is a Bayesian inversion.

6. A method as claimed in claim 4 or 5, wherein a first part of the solution to the inversion is a posterior expectation.

7. A method as claimed in claim 6, wherein the posterior expectation corresponds to changes in the parameters of the model.

8. A method as claimed in any one of claims 4 to 7, wherein a second part of the solution to the inversion is a posterior covariance.

9. A method as claimed in claim 8, wherein the posterior covariance corresponds to the uncertainty in the posterior expectation.

10. A method as claimed in any preceding claim, wherein changes in the parameters of the model follow Gaussian statistics.

11. A method as claimed in any preceding claim, wherein the difference has an associated error model with a corresponding error term.

12. A method as claimed in claim 11, wherein the error term corresponds to the difference between (i) the difference between the first and second measured data, and (ii) the changes in the parameters of the model when operated upon by a forward modelling operator.

13. A method as claimed in claim 11 or 12, wherein the error term $\mathbf{e}$ is related to the difference $\mathbf{d}$ between the first and second measured data and the changes δ in the parameters of the model when operated upon by a forward modelling operator $\mathbf{G}$ via the matrix-vector expression $\mathbf{d} = \mathbf{G}\delta + \mathbf{e}$.

14. A method as claimed in any one of claims 11 to 13, wherein the statistical properties of the error term is described via an expectation and a covariance.

15. A method as claimed in claim 14 wherein the error term follows Gaussian statistics.

16. A method as claimed in any one of claims 11 to 15 when dependent on claim 6, wherein the error term is used to determine the posterior expectation.

17. A method as claimed in any one of claims 11 to 16 when dependent on claim 8, wherein the error term is used to determine the posterior covariance.

18. A method as claimed in any one of claims 11 to 17, wherein the physical system has a part which is the same in the first and second states, measurements of this part being used to determine statistical properties of the error term.

19. A method as claimed in any preceding claim, wherein the prior knowledge about the changes of the parameters of the model is defined in a prior model.

20. A method as claimed in claim 19, where the prior model is defined via a prior expectation and a prior covariance.

21. A method as claimed in claim 20, where the prior model follows Gaussian statistics.

22. A method as claimed in any one of claims 19 to 21 when dependent on claim 16, where the prior model for the changes of the parameters of the model is used to determine the posterior expectation.

23. A method as claimed in any one of claims 19 to 22 when dependent on claim 17, where the prior model for the changes of the parameters of the model is used to determine the posterior covariance.

24. A method as claimed in any preceding claim, wherein the seismic data are reflection data.

25. A method as claimed in any preceding claim, wherein the parameters of the model are any complete set of elastic properties that can be used to formulate a linear expression of reflectivity.

26. A method as claimed in claim 25, wherein the parameters of the model are the P-wave velocity, the S-wave velocity, and the density.

27. A method as claimed in claim 25, wherein the parameters of the model are the acoustic impedance, the shear impedance, and the density.

28. A method as claimed in any preceding claim, wherein the physical system includes a region containing a hydrocarbon reservoir.

29. A method as claimed in any preceding claim, wherein the obtained changes in the parameters of the model are used to assess where changes in the physical system have occurred between the first and second states.

30. A method as claimed in claim 29 when dependent on claim 28, wherein the obtained changes in the parameters of the model are used to assess the change in hydrocarbon content in the hydrocarbon reservoir.

31. A method as claimed in any preceding claim, wherein the obtained changes in the parameters of the model are used to assess the probabilities of changes in the physical system between the first and second states.

32. A method as claimed in claim 31, wherein the probabilities of changes in the physical system are used to generate a probability density map of changes in the physical system.

33. A program for controlling a computer to perform a method as claimed in any one of claims 1 to 32.

34. A program as claimed in claim 33 stored on a storage medium.

35. Transmission of a program as claimed in claim 33 across a communications network.

36. A computer programmed to perform a method as claimed in any one of claims 1 to 32.

37. An apparatus for processing data representing a physical system, the apparatus comprising:

means for forming a difference between first and second measured data representing the system in first and second states, respectively; and

means for inverting the difference in accordance with a parameterised model of the physical system to obtain changes in the parameters of the model.